

REMARKS

By this reply, claim 17 has been cancelled; claims 1, 8, 12 and 16 have been amended without narrowing the scope of any one of claims 1, 8 and 12; and new claim 30 has been added, leaving claims 1-5, 7-16, 18 and 20-30 pending in the application. Reconsideration and allowance are respectfully requested in view of the following remarks.

Restriction Requirement

Applicant notes that claims 14-18, 20-25 and 29 have been withdrawn from consideration as being directed to non-elected subject matter.

First Rejection Under 35 U.S.C. § 103

Claims 1, 4, 5, 7-9 and 11-13 stand rejected under 35 U.S.C. § 103(a) over U.S. Patent No. 4,024,617 to McCormick ("McCormick") in view of U.S. Patent No. 3,066,042 to Ogden ("Ogden") and U.S. Patent No. 3,617,349 to Prasse ("Prasse"). The reasons for the rejection are stated on pages 3-6 of the Office Action. The rejection is respectfully traversed.

Claim 1 recites a method of applying a wear resistant coating material to a surface (22) of a piston ring (1). The claimed method comprises "applying said coating material by a thermal spray process, heat treating said coating material at an elevated temperature and for a time effective to at least partially diffuse said coating material into the underlying surface, by exposing said material to heating temperature below the melting point of the coating material, and applying additional coating material layers (24) subject to successive heat treatments of each said

applied coating material layer (24) in order to lay down on said piston ring surface (22) a plurality of layers (24) of same said coating material, wherein said resulting piston ring coating including the plurality of applied layers (24) has a porosity of between 1 to 15 vol%. Claim 1 has been amended to further clarify that the resulting piston ring coating, which includes the plurality of applied layers, has a porosity of 1 to 15 vol%. As recited in claim 1, each of the plurality of applied layers of the piston ring coating is heat treated.

The Office Action admits that McCormick does not disclose forming a coating on a surface of a piston ring by applying multiple layers with a heating diffusion treatment after each layer is applied. However, the Office Action asserts that Ogden teaches applying multiple thin layers and respective following heat treatments to achieve a desired coating thickness. The Office Action further asserts that Prasse teaches a spray-applied coating having an open porosity of 7-20%. The Office Action then asserts that it would have been obvious to modify McCormick to apply multiple layers of coating with a heating diffusion treatment after each layer is applied, in view of Ogden, and further that it would have been obvious to modify McCormick in view of Ogden based on Prasse to optimize the porosity through the diffusion heat treatment to achieve a final open porosity of 7 percent. Applicant respectfully disagrees with these assertions.

Ogden discloses a method for applying a multi-layer coating. Ogden's method comprises the steps of applying a coating layer to a substrate, shot peening the coating layer, and heat treating the coating layer to thereby eliminate pores in the coating. These steps are then repeated for additional layers to form a multi-layered coating. Ogden discloses that the "consequent diffusion of the layer eliminates the

pores" (column 2, lines 27-28). Furthermore, in the Example described at column 2, lines 50-59 of Ogden, the molybdenum layer including multiple layers was substantially non-porous. Accordingly, Ogden does not suggest modifying McCormick to result in the claimed resulting (i.e., heat treated) piston ring coating having a porosity of between 1 to 15 vol%. In fact, Ogden teaches directly away from forming a porous coating. However, as stated in M.P.E.P. 2141.02(VI), "a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would have lead away from the claimed invention" (citation omitted). Applicant submits that the Office Action has improperly disregarded portions of Ogden that expressly teach away from modifying McCormick in the manner advanced in the Office Action.

Moreover, Prasse fails to cure the deficiencies of McCormick and Ogden with respect to the claimed subject matter. More particularly, Prasse also would not have suggested modifying McCormick to result in the claimed resulting multi-layered coating with the recited porosity after heat treatment. Prasse discloses that "for best results the porous metal or metal alloy should have an open porosity ranging from about 7 percent to about 30 percent by volume of the outer surface of the thus-coated bearing face" (emphasis added; column 2, lines 63-66). Subsequently, the coating having such initial porosity is impregnated with an antifriction agent using heating. Thus, Prasse discloses the coating porosity before the heat treatment step, not after the coating has been subjected to heat treatment. Prasse does not disclose or suggest forming a coating with multiple layers that has the claimed porosity after having been heat treated.

Thus, because none of the applied references disclose or suggest features of the claimed method, even if the references were combined despite there being no motivation or suggestion for the proposed combination, the applied teachings of the references still would not result in the claimed method. Thus, the Office Action has not established *prima facie* obviousness. See M.P.E.P. § 2143.03. Therefore, claim 1 is patentable. Claims 4, 5, 7-9 and 11-13, which depend from claim 1, are also patentable for at least the same reasons as those for which claim 1 is patentable.

Therefore, withdrawal of the rejection is respectfully requested.

Second Rejection Under 35 U.S.C. § 103

Claims 2, 3, 10 and 26-28 stand rejected under 35 U.S.C. § 103(a) over McCormick in view of Ogden and Prasse, and further in view of U.S. Patent No. 5,713,129 to Rastegar et al. ("Rastegar"). The reasons for the rejection are stated on pages 6-8 of the Office Action. The rejection is respectfully traversed.

Rastegar has been applied in the Office Action for allegedly disclosing the rotation of piston rings while spraying molten material on the piston rings. Applicant submits that Rastegar does not cure the above-discussed deficiencies of the other applied references with respect to the method recited in claim 1. Accordingly, claims 2, 3, 10 and 26-28, which depend from claim 1, are patentable over the applied combination of references.

Therefore, withdrawal of the rejection is respectfully requested.

New Claim

New claim 30 recites "a piston ring coated with a wear resistant coating material formed by the method according to claim 1, wherein the piston ring comprises a surface and the wear resistant coating material partially diffused into the surface, the coating includes a plurality of as-heat treated applied layers (24) having a porosity of between 1 to 15 vol%, and the piston ring comprises necks (23) in contact points between particles (21) in at least the coating." As set forth in Annex B, Unity of Invention, Administrative Instructions Under the PCT, at clause (e), Applicant is permitted to include claim 30 in this application. Moreover, Applicant submits that there is unity of invention between the method of claim 1 and the article or product of claim 30. Claim 30 is also patentable.

Conclusion

For the foregoing reasons, allowance of the application is respectfully requested. If there are any questions concerning this response, the Examiner is respectfully requested to contact the undersigned at the number given below.

Respectfully submitted,

BUCHANAN INGERSOLL PC

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By:  _____

Edward A. Brown
Registration No. 35,033

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620